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Human Knowledge with Fuzzy Ideas

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ABSTRACT : *Natural language is the most powerful form of conveying information. Most of the predicates in natural language are Fuzzy. Fuzzy logic is a concept to represent vague ideas and it deals with uncertainty. Human knowledge can be represented through an approach using Fuzzy concepts, an approach to computing based on "degree of truth "rather than the usual True or False. Fuzzy Logic uses linguistic variables and are modified with hedges like very, low, slight, approximately etc. and the truth values of propositions are in the range over the unit interval [0, 1] which are called linguistic truth value.*

KEYWORDS : *Defuzzification, Fuzzy sets, Linguistic hedges, membership functions, propositions.*

I. INTRODUCTION

The study of how to make computers do things which, at the moment, people do better is Artificial Intelligence. Fuzzy logic concept plays a vital role in Artificial Intelligence. In real world there exists much fuzzy knowledge. These are vague, imprecise and uncertain in nature. In some situations, two valued logic is unable to solve particular problems. Human thinking and reasoning involve fuzzy information. Many real-world problems can be solved using fuzzy concept. Fuzzy systems are very useful in situations involving highly complex systems where an approximate and fast solution is wanted.

II. FUZZY REPRESENTATION

The important property of fuzzy set is that it allows partial membership. Membership function for a fuzzy set $\tilde{A}$ on the universe of discourse X is defined as $\mu_{\tilde{A}} : X \rightarrow [0,1]$, where each element of X is mapped to a value between 0 and1 and is called membership value or degree of membership. Graphical representation of fuzzy set can be done using membership functions. Normally a fuzzy set $\tilde{A}$ in the universe of discourse X can be defined as a set of ordered pair $\tilde{A}=\{(x, \mu_{\tilde{A}}(x) \mid x \in X\}$.In fuzzy concepts, the range of values from 0 to 1 where 0.0 represents absolute truth and 1.0 represents absolute truth.

$$\tilde{A}=\{0.6/\text{Train}+0.3/\text{Bike}+0.8/\text{Cycle}\}$$

In the basic representation of fuzzy sets, the upper value is known Membership Degree and the highest value of degree of membership is 1 and lowest is 0. In Normal fuzzy sets at least one element x whose membership value is 1.The height is the maximum value of the membership function and in the case of normal fuzzy set the height is equal to 1.Membership function has the features like Core, Support and Boundary in which Core is region which has complete and full membership, support has a region which is characterized by a non-zero membership and boundary is a region of universe containing element that have non zero but not complete membership.

III. FUZZIFICATION AND DEFUZZIFICATION

In the real world, experimental crisp dates may be erroneous. To avoid this, we should transform crisp set to a fuzzy set or a fuzzy set to fuzzier set. That is crisp quantities are converted to fuzzy quantities, using membership functions. Normal methods of Fuzzification are support Fuzzification(S-fuzzification) and Grade Fuzzification (G-fuzzification).The process of reducing a fuzzy set into a crisp set or to convert a fuzzy member into a crisp member is defuzzification. Mathematically the process of defuzzification is also called "rounding it off".For a fuzzy set $\tilde{A}$ we can define a lambda cut set A_λ, where $0 \le \lambda \le 1$. The set A_λ is a crisp set called the lambda cut (λ-cut) or alpha cut (α-cut) set of the fuzzy set $\tilde{A}$. Any particular fuzzy set $\tilde{A}$ can be transformed into an infinite number of lambda cut set because there are an infinite number of values lambda on the interval [0, 1].

$$A_\alpha = \{x|\mu_{\tilde{A}}(x) \ge \alpha\}$$

A set A_λ is called a weak lambda cut set if it consist of all the elements of the fuzzy set whose membership functions have values greater than or equal to a specified value.

$$A_\alpha = \{x| \mu_{\tilde{A}}(x) \ge \alpha\};\ \alpha \in [0, 1]$$

Strong alpha cut set consist of all the elements of the fuzzy set whose membership functions have values strictly greater than a specified value.

$$A_\alpha = \{x|\mu_{\tilde{A}}(x) > \alpha\};\ \alpha \in [0, 1]$$

For example, we can consider the discrete fuzzy set using Zadeh's notation $\tilde{A}$={1/car+0.6/Train+0.3/Cycle} and can be reduce it in to several α-cut set for the values of α=1, 0.6, 0.3 is
A_1= {car}, $A_{0.6}$= {Car, Train} and $A_{0.3}$= {Car, Train ,Cycle}.

IV. LOGIC FUZZY SYSTEM AND FUZZY PREDICATE

Normally, Fuzzy logic uses linguistic variables for example, height is a linguistic variable if it takes values such as tall, medium, short, etc. The values of linguistic variables are words or sentences. In linguistics fundamental atomic terms are often modified with nouns or verbs like very, low, slight, more, less, almost, approximately, minus, fairly, etc. called linguistic hedges. The singular meaning of an atomic term is modified or hedged from its original interpretation. The truth value of propositions in fuzzy logic is allowed to range over the unit interval [0, 1]. The truth value of A defined by a point in [0, 1] called numerical truth value and a fuzzy set in [0, 1] called the linguistic truth value. In fuzzy logic the predicate can be fuzzy. Most of the predicates in natural languages are fuzzy. Predicate modifiers act as hedges. Very, fairly, slightly, rather, predicate modifiers are necessary for generating the values of linguistic variables. The fuzzy quantifiers are most, several, many, frequently, etc. Fuzzy truth qualification, fuzzy probability qualification, fuzzy possibility qualification, and fuzzy usuality qualification are the fuzzy qualifiers. "If the temperature is positively high and fan speed is rather low then flow rate is very high". Here the term positively, rather and very constitute the hedges that shape the behavior of the respective fuzzy sets.

V. CONCLUSION

Knowledge contains descriptions which are vague, ambiguous, in exact or reflects uncertainty then it is essential to model the vagueness such that the description can be engineered on a computer system. We can modify the shape of a fuzzy set using fuzzy hedges like every, definitely, rather etc. Human knowledge can be implemented using IF-THEN rule.

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